



Enhancing the Security of Automated Teller Machine in Nigeria using Iris Recognition Techniques

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ABSTRACT

Automated Teller Machine (ATM) is a product of global technological invention in recent times that has resulted in excellent service delivery to customers of commercial banks in Nigeria by offering services such as cash withdrawals, cash deposits, funds transfer, utilities payment, cheque book requests and other financial enquiries. The current methods of Pin Identification Number (PIN) used for identification and authentication by Nigerian banks has not been able to meet the growing demands for stringent security as it has been subjected to a lot of abuses and other fraudulent activities such card theft, collecting user's security information among other. The paper proposed an enhanced security for the Automated Teller Machine in Nigeria using a combination of Personal Identification Number (PIN) and Iris Recognition techniques. The results show that the proposed security measures outperformed the current Pin Identification Number used by banks in Nigeria and the Fingerprint identification used in some other countries.

Keywords: Automated Teller Machine, Biometric Technologies, Iris, Fingerprint Recognition.

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1. BACKGROUND TO THE STUDY

Crime at ATM's has become a national issue currently confronting not only customers, but also bank operators (Boateng & Molla, 2006). Enhanced Security measures will on the long run plays a critical role in preventing ATM'S frauds and other abuses currently terrorizing the Banking systems and Nigerian's image in the international communities. Biometrics refers to the automatic recognition of individuals based on their physiological and behavioral characteristics. It requires physically present at the point of identification. Identification based on biometric techniques lessens the need to remember a password or carry a token like a physical ID. Various biometric traits are being used for real-time recognition, the most popular being face, iris and fingerprint. Biometrics technologies are becoming the foundation of an extensive array of highly secure identification and personal verification solutions. Today, biometric is being spotlighted as the authentication method because of the need for reliable security (Cappelli et al., 2007).

The demands and emphasis for increase security nowadays has made biometric technologies more important than ever (Li, & Liu, 2008) and Iris recognition in recent years has receives growing interests. Iris pattern recognition is unique to each subject, remains stable throughout life and offers several distinct advantages (Daugman, 1993, Daugman, 2003, Li, & Liu, 2008). Especially, it is protected by the body's own mechanisms and impossible to be modified without risk. Thus, iris is reputed to be the most accurate and reliable for person's identification (Jain, Bolle and Pankani, 1999) and has received extensive attentions over the last decades. The degree of freedom of iris textures is extremely high, the probability of finding two identical irises is close to zero and therefore, iris recognition systems are very reliable and could be used in most secure places (Monaheng & Kuruba, 2013).



Biometric systems can either be physiological or behavioural depending on the characteristics used. Human signatures and voice are classified as behavioural while face, figure print and iris traits are physiological. The first step of any biometric system is capturing a sample of a feature, such as recording a digital sound signal for voice recognition, or taking a digital eye image for iris recognition. Among the various traits, iris recognition has advantages like high speed of computation because of sample size, simplicity and accuracy compared to other biometric traits (Zhu, Tan & Wan, 2000). Iris recognition relies on the unique patterns of the human iris in identification and verification of an individual.

1.1. Statement of Problems

The current methods of Pin Identification Number (PIN) used for identification in Automated Teller Machine (ATMs) by Nigerian banks has not been able to meet the growing demands for stringent security as it has been subjected to a lot of abuses and other fraudulent activities such as card theft, collecting user's security information among other. The paper proposed an enhanced security for the Automated Teller Machine in Nigeria using a combination of Personal Identification Number (PIN) and Iris Recognition techniques. The proposed security measures is believed to outperformed the current Pin Identification Number used by banks in Nigeria and the Fingerprint identification used in some other countries

1.2 Objectives

The objectives of this research are:-

- (i) To carry out extensive literature review on the existing biometric security methods used in automated teller machine in Nigeria and other African countries.
- (ii) To propose and develop an enhanced security technique based on the combination of Pin Identification Number and Iris Recognition techniques.

2. REVIEW OF RELATED LITERATURE

Most of the work on Biometric security had been carried out on Fingerprint and Face recognition techniques. With the move towards digitalization and globalization being accelerated every hour, biometrics technologies have begun to affect people's daily life more and more. Biometrics technologies verify the identity through characteristics such as fingerprints, faces, irises, retinal patterns, palm prints, voice, hand-written signatures, and so on. These techniques, which use physical data, are receiving attention as a personal authentication method that is more convenient than conventional methods such as a password or ID cards (Kadry, & Smaili, 2013). Biometric personal authentication uses data taken from measurements. Such data is unique to the individual and remains so throughout one's life. This technology has been applied for controlling access to high-security facilities, but it is now being widespread developed in information systems such as network, e-commerce, and retail applications. In these technologies, iris recognition becomes the most mature and popular biometrics technology used in automatic personal identification.

Kadry, and Smaili (2013) carried out Wireless attendance management system based on iris recognition. The Wireless iris recognition attendance management system is designed and implemented using Daugman's algorithm). This system based biometrics and wireless technique solves the problem of spurious attendance and the trouble of laying the corresponding network. It can make the users' attendances more easy and effective. This system possesses the functions of iris recognition which includes verifying, checking on attendances independently, and wireless communication and so on. The performance of this system meets the needs of daily attendance management in various enterprises and institutions.

Mahmudova (2016) carried out a critical review of the Application Opportunities of Biometric Technology in Electron Libraries. The paper provides information about biometric technologies, traditional and electronic libraries. Opportunities and prospects of the use of biometric technologies in libraries were also analyzed. The researcher stresses that when using traditional methods, data loss or theft may occur, whereas emergence of such threats is not possible in biometric identification while the application of biometric identification systems is very vital in some certain applied areas such as border stations, passenger registration, electronic identification document and cards control, and in some security issues. Library is one of these application areas. Technology is rapidly developing, at the same time, safety rules are violated, and fraud is growing all over the world. Therefore, all businesses, as well as libraries need biometric technologies for the control and security. The advantages and disadvantages of introduction of biometric technologies in libraries were also explained.



Chhatbar (2015) carried out a detailed study of Iris Recognition. The researcher in his paper considered Iris recognition to be the most reliable and accurate biometric identification system available. The features of the iris were encoded by convolving the normalized iris region with 1D Log-Gabor filters and phase quantizing the output in order to produce a bit-wise biometric template. The Hamming distance was chosen as a matching metric, which gave the measure of how many bits disagreed between the templates of the iris. The developed iris recognition produced a very good result as the hamming distance is close to zero which means patterns are match completely.

3. METHODOLOGY

This research work is based on the design and implementation of an enhanced security for the Automated Teller Machines (ATM) using combination of Pin Identification Number (PIN) and Iris recognition techniques. The proposed system will among other things prevent the current abuses and fraudulent activities in our Automated Teller Machine (ATMs) across the country. The security features for enhancing the ATM was designed using the client/server approach. There will be a link between the customer's identification information, customer's accounts and records in the bank (server). The network is designed to support a large number of users and dedicated server is used to accomplish this. The reason for choosing Client/Server model for this application is because it provides adequate security for the resources required for a critical application such as Banking. Unified Modeling language (UML) tools such as Use case modeling diagrams and activity flow diagram will be used to model the relationship among the functional components of the system. Microsoft Access 2010 will be used as the database software (Back-end) to create database to store cardholder's information and their Iris scan while Microsoft C# 2012 is used as the programming language (front-end) to design the user interfaces and cardholder interaction with the ATM Machine.

4. DISCUSSION OF FINDING

The findings are discussed below.

4.1 Proposed Systems Model

The proposed software design involves two phases namely: registration phase and verification phase.

- (a) **Registration phase:-** The Registration phase creates profile for the card owner. This process is carried out by the administrator of the system. Information about the card owner is captured, his iris scan is taken, and Personal Identification Number (PIN) is generated for the customer which is supposed to change at the first log on.
- (b) **Identification and Verification process:-** Once the individual has been enrolled in a system, he/she can start the use of biometric technology to have access to his account via the ATM machine to authorize transaction. In Identification phase, the user provides his/her PIN and a biometric sample of his/her Iris using an Iris reader interface display by the Automated Teller Machine (ATM). In the Verification phase, the system simply verifies if the information entered by the user is correct by comparing the biometric sample with the provided identification previously stored information in the database. If there is a match, access is provided. After the identification and verification, customer request for a type of transaction accordingly. At the completion of the transaction, the customer exit Application and remove his/her card.

4.2 Functional Model of the System

The functional model of the systems is depicted using the Use Case Modeling diagram as shown in the Figure 1. The actors are the System administrator (Customer Service Staff) and Bank's Customers.

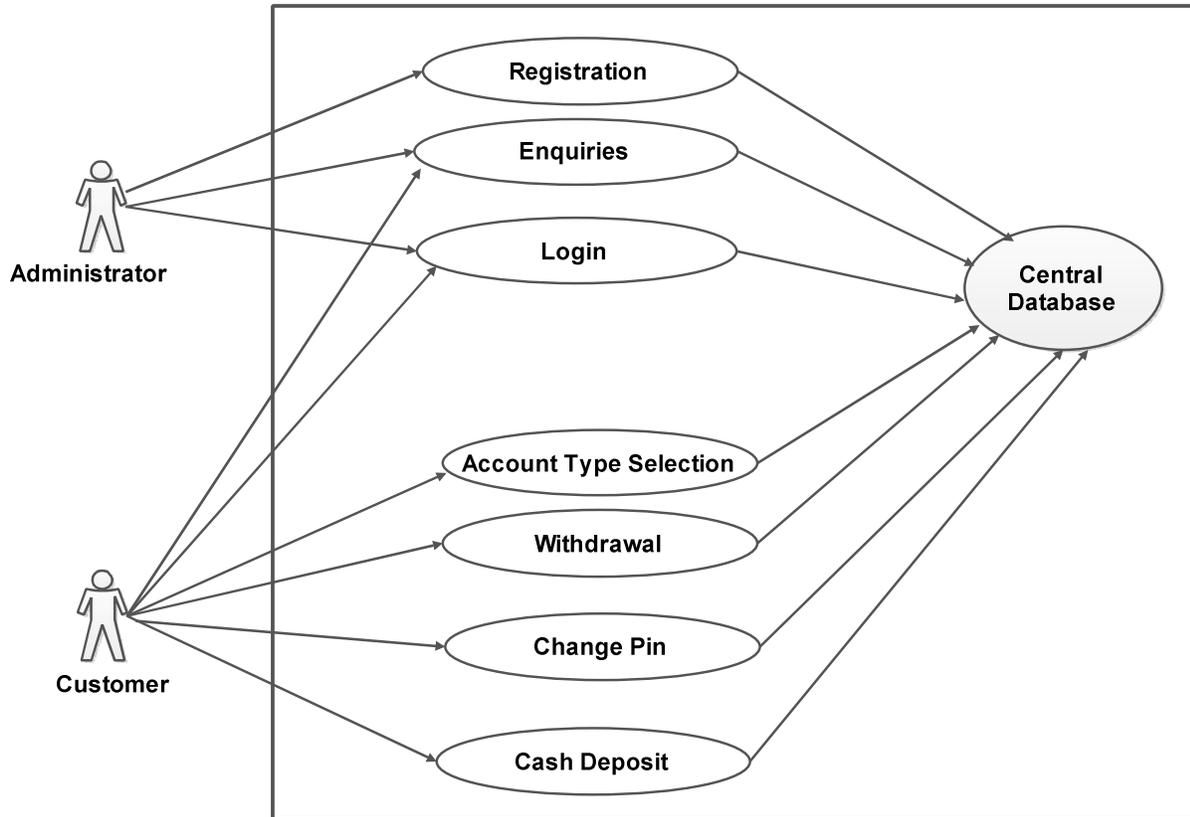


Figure 1: Use Case Modeling Diagram for Customer transactions and Administrator functions

4.3 Activity Flow Diagram of the System

The activity diagram describes the behaviour of the proposed system in terms of activities. Activities are modeling elements that represent the execution of a set of operations. The execution of an activity can be triggered by the completion of other activities, by the availability of objects, or by external events. The activity flow diagram is used to depict the Algorithm for the System and is shown in the figure 2.

4.4 Results And Discussion

The proposed system is a system that uses Iris recognition techniques. This system was implemented using Microsoft C#.Net programming language. It involves the interaction with the central database which contains all records of customers including his/her Iris scan. In implementing this system, certain criteria are considered. The criterion is that only eligible customers with valid ATM card can use the systems. The design requirements are met through the use of n Iris reader camera which captures the Iris of users. Desirable results are achieved, some of which are discussed in this section.

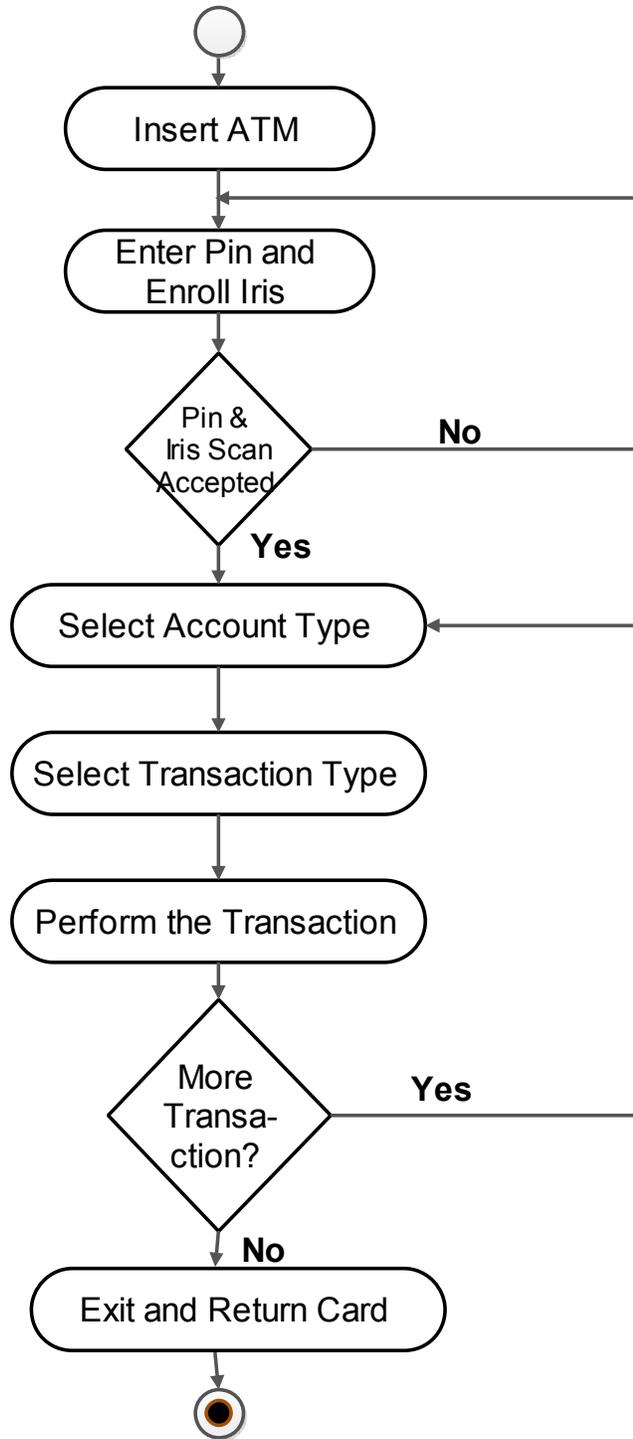


Figure 2: Activity Flow Diagram for Customer's transaction



4.4.1 Login Interface

This is a Menu that enables the Administrator and Customers to have access to the system.

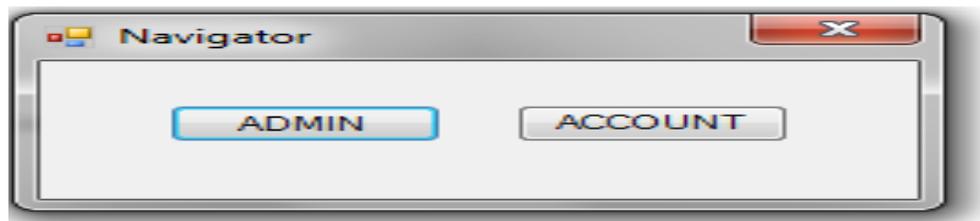


Figure 1.3: Login Interface for Customers and Administrators

4.4.2 Registration Interface

This phase is where the customer is enrolled by the administrator and his/her Iris Scan taken. An account number is assigned to the customer immediately the administrator submitted the entry.

A screenshot of a web-based registration form for "DIAMOND BANK". The window title is "DIAMOND BANK" and it has a close button (X) in the top right. The interface includes a navigation menu with "Home", "Tools", and "Help" buttons. The form is divided into two main sections: "Basic Info" and "Account Info".
Basic Info: Includes fields for TITLE (dropdown menu with "Mr." selected), FIRSTNAME (text input with "Felix"), LASTNAME (text input with "Idepefo"), NATIONALITY (text input with "Nigeria"), STATE (text input with "Ondo"), TELEPHONE (text input with "8888888888"), E-MAIL (text input with "felixidepefo@yahoo.com"), DOB (Date, Month, Year inputs with "09", "01", "2000"), MARITAL STATUS (dropdown menu with "Single" selected), RELIGION (dropdown menu with "Christian" selected), and ADDRESS (text input).
Account Info: Includes fields for TYPE OF ACCOUNT (dropdown menu) and INSTANCE AMOUNT (text input).
IRIS Reaser: This section contains two side-by-side images of a person's face, each showing the iris. Below the images are two buttons: "IRIS SCAN" with a magnifying glass icon and "SNAP IRIS".
At the bottom of the form, there are two buttons: "Submit" with a green checkmark icon and "Clear" with a red X icon.

Figure 4: Registration Interface



An account Number is assigned to the customer immediately the form is submitted as shown below.

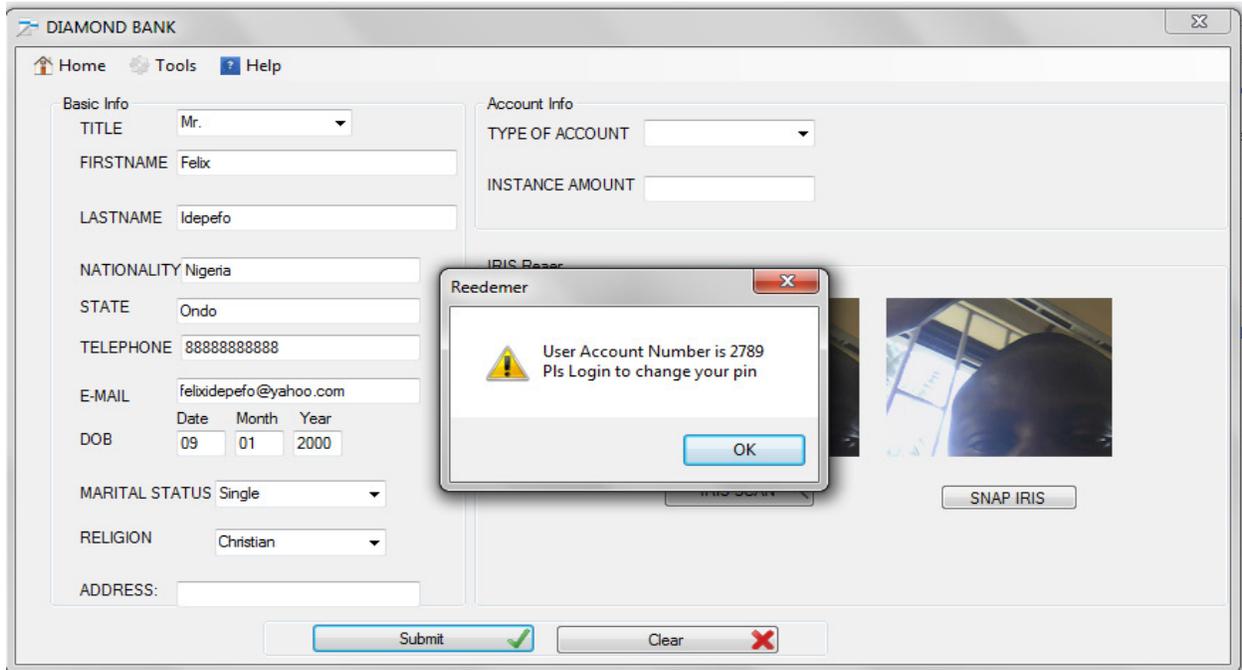


Figure 5: Account Number Assignment Interface

4.4.3 Account Type Selection Interface

This Interface allows the customer to select the type account.

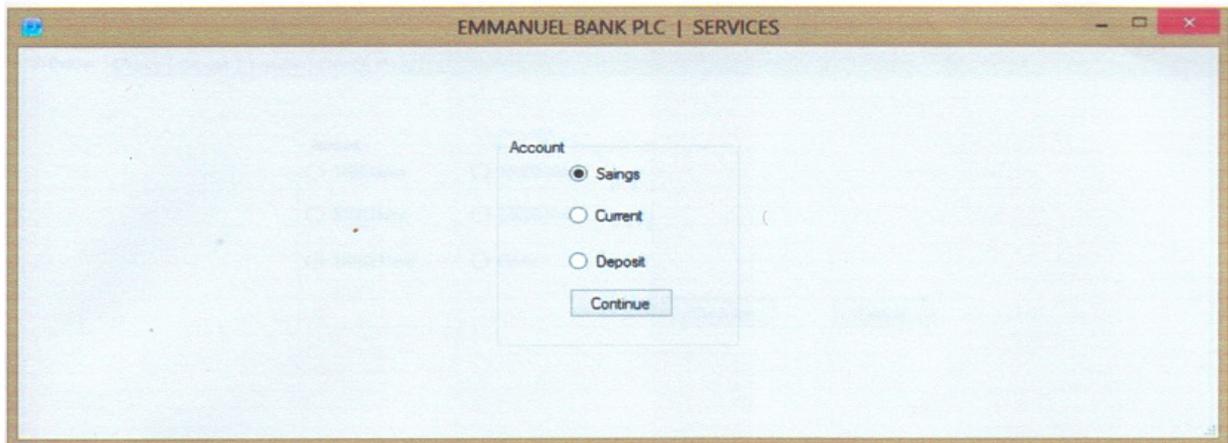


Figure 6: Account Type Selection Interface



4.4.4 Withdrawal Interface

This Interface is used by customer for cash withdrawal.

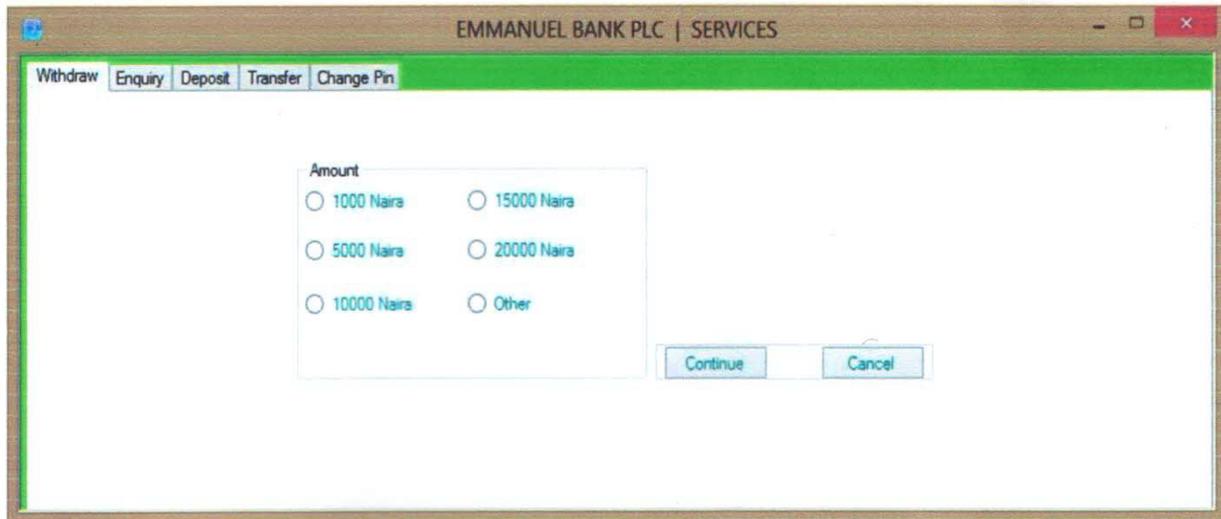


Figure 7: Withdrawal Interface

4.4.5 Enquiry Interface

This Interface is used by the customer for enquiries such as checking balances and view account statement.

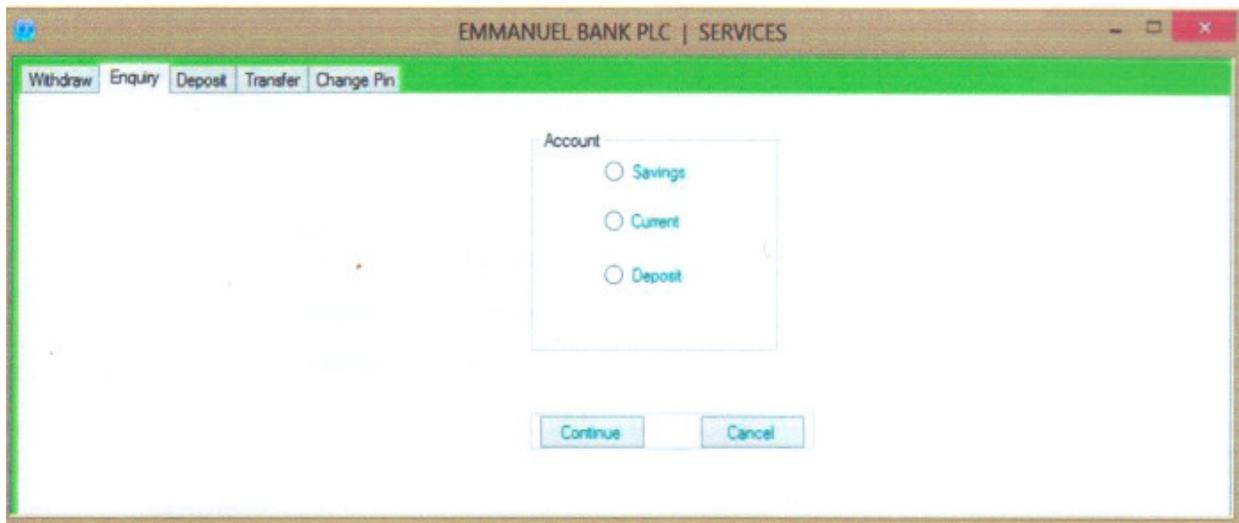


Figure 8: Enquiry Interface



4.4.6 Change Pin Interface

This Interface is used by the customer to change his/her Pin.



Figure 9: Change Pin Interface

5. CONCLUDING REMARKS

The researchers have been able to develop an Iris recognition technique that will enhance Automatic teller machine in Nigeria and provide effective banking transactions for Bank customers. The uniqueness of the iris and low probability of a false acceptance or false rejection all contribute to the benefits of using iris recognition technology (Mahmudova, 2016). It provides an accurate and secure method of authenticating users onto company systems, is a non-intrusive method and has the speed required to minimise user frustration when accessing company systems. The prototype of the developed proposed system has been found promising on the account of its sensitivity to the recognition of the customers' Iris scan as contained in the database. This system when fully deployed will definitely reduce the rate of fraudulent activities on the ATM machines such that only the registered owners of a card have access to the bank account. The proposed system has achieved a recognition accuracy of 95.6%.

6. CONTRIBUTION TO KNOWLEDGE

The researchers have been able to develop an Iris recognition technique that will enhance Automatic teller machine in Nigeria and provide effective banking transactions for Banks. The proposed system provides an accurate and secure method of authenticating users for banking transactions, is a non-intrusive method and has the speed required to minimise user frustration when accessing company systems.



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